Determining Management Reserve Using an Integrated Risk Management Approach

International Federation of Operations Research Societies

Presented by:
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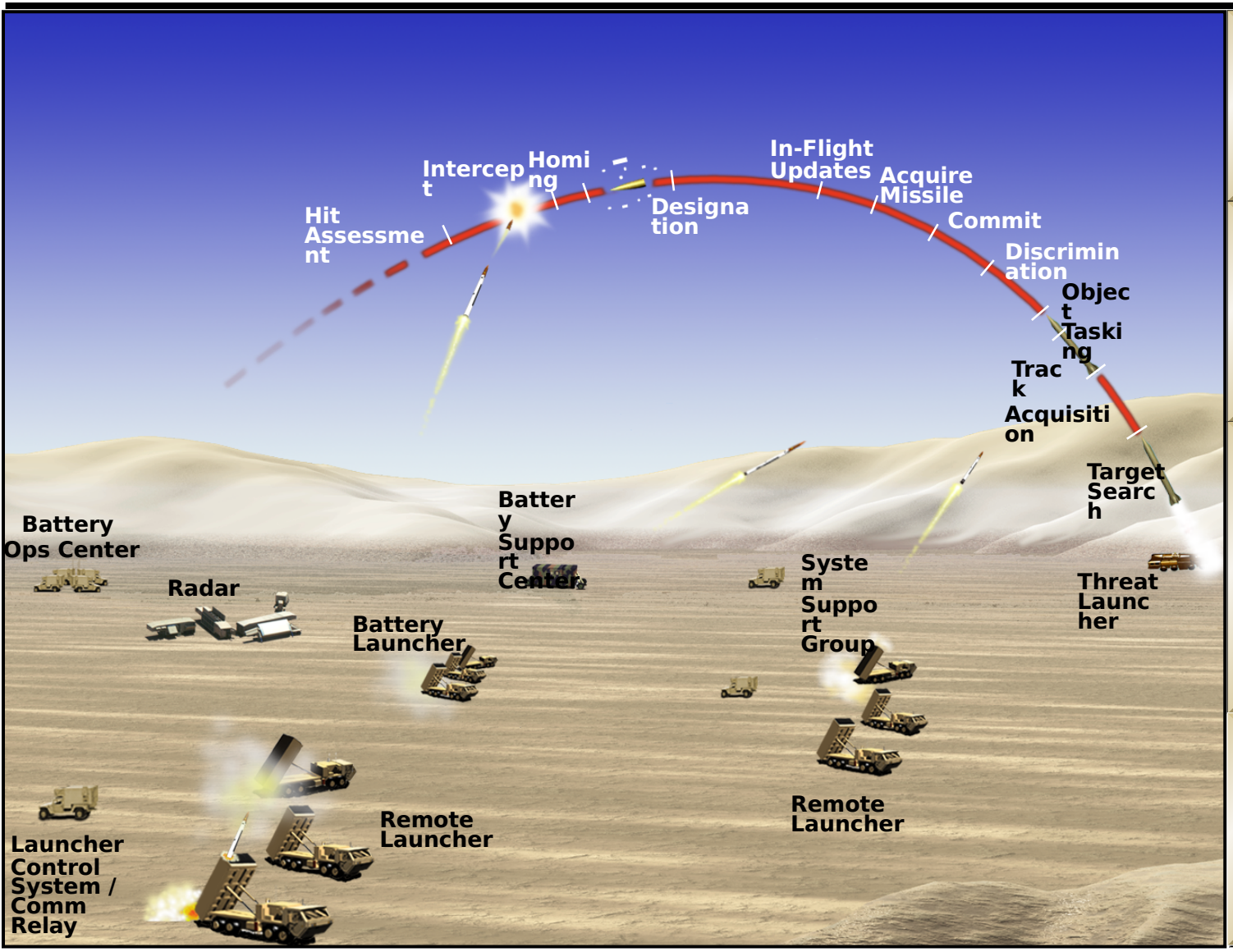
Agenda

- Program Overview
- Issue – Budgeting for “Risk”
- Risk Management Overview
- Determining Management Reserve
- Benefits of Methodology
- Keys to Successful Implementation
- Summary

Defense System Description



Launcher

- HEMTT based
- Highly mobile

Missile

- Robust capability
- Inertially guided with in-flight updates
- On-board seeker acquires target for endgame homing

Radar

- Extensive detection / coverage
- Robust Discrimination
- Target and interceptor track
- Hit assessment
- In-flight target updates to missile

BM/C3I

- Distributed operation
- Engagement planning & control
- Interoperability

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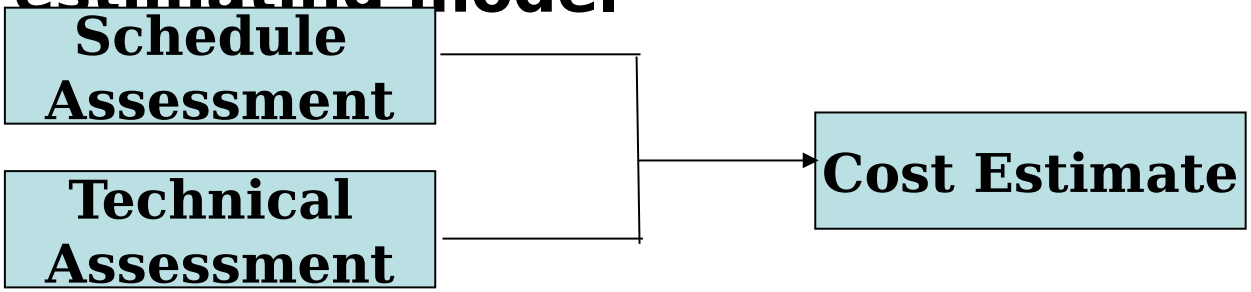
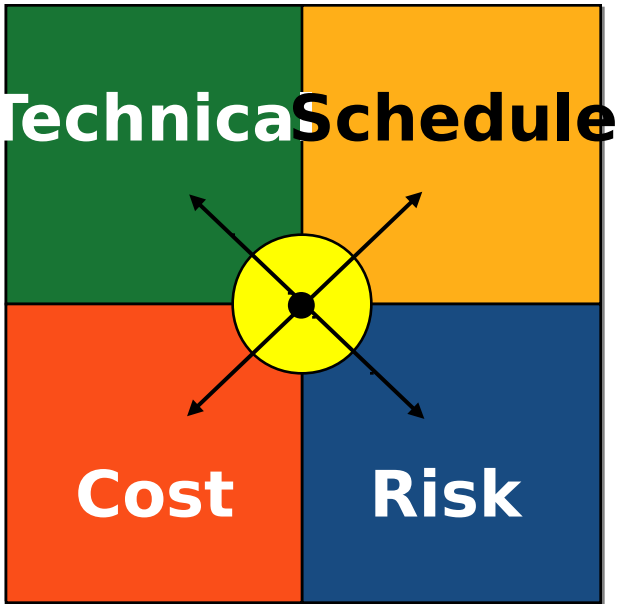
Cost Estimating Issue

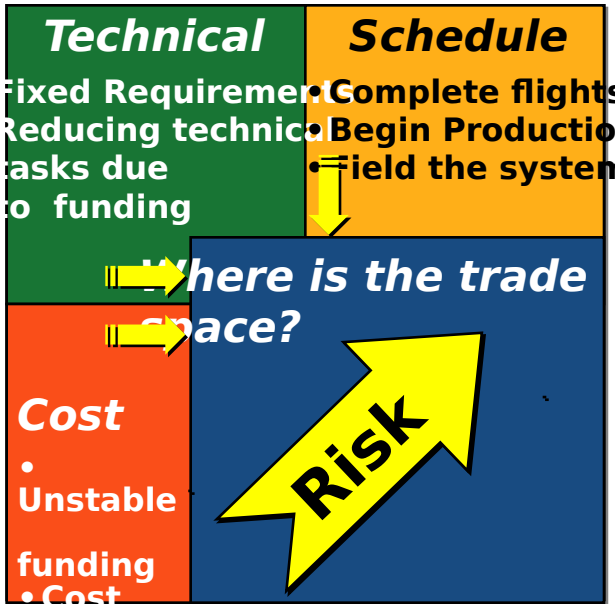
Issue: ***How should dynamic Department of Defense (DoD) acquisition programs plan & budget for anticipated program risks?***

Proposed Solution: Integrate the technical and schedule risk assessments with the program's cost estimating model



Program Manager's Challenge





PM's Mission:

Balance the four major program areas Effectively.

PM's Dilemma:

Fixed or increasing requirements for technical, schedule, & cost performance are increasing program risk.

Challenge: ***How to estimate the potential cost growth due to risk factors; especially challenging for DoD because of the long budget cycle***

Risk Management

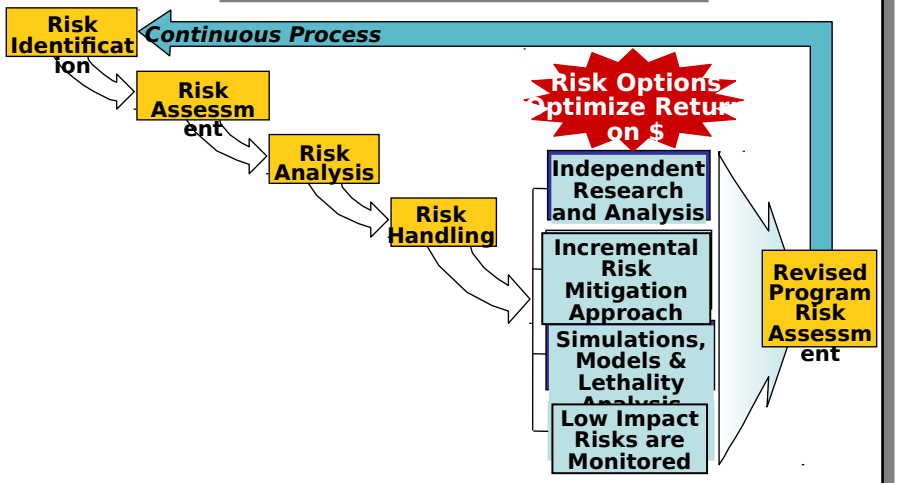
What is Risk & Risk Management

- Risk can be described as the possibility of an undesirable event
- RISK = Probability (P_f) + Consequence (C_f)
- Probability describes the likelihood of the event occurring
- Consequence denotes the magnitude of loss
- Pr[illegible] to [illegible]rs

Risk Management Objectives

- Identify Program risks early to ensure appropriate mitigation
- Provide a decision making tool
- Provide a basis for management actions: balancing system, award fee criteria, management reserve application
- Provide a tracking and reporting system

Risk Management Process



Risk Exposure Matrix

Types of Risk	External: Factors Outside of the Organization's Contr	
☑ Technical	- Funding	- Safety Hazards
	- Treaties/Politics/Threat	- Defense Industrial Base
☑	- Obsolescence	- Environmental Considerations
	- Technology Insertion	- Compressed Schedules
☑ Cost	**Internal: Factors Within an Organization's Control**	
	- Design Stability	- Prototype Re-work
Schedule	- Quality Control	- Manufacturing Process
	- Shelf Lives	- Increased Testing
	- Cost Growth Management	– Experience Bas

Risk Management Plan

1.0 INTRODUCTION

2.0 PROGRAM SUMMARY

3.0 RISK MANAGEMENT STRATEGY AND APPROACH

4.0 RISK MANAGEMENT PROCESSES & PROCEDURES

5.0 RISK MANAGEMENT GUIDANCE

- **Risk Planning**
- **Risk Assessment (Probability and Consequence defined)**
- **Risk-Handling**
- **Risk Monitoring**

6.0 RISK MANAGEMENT INFORMATION SYSTEMS

7.0 RISK DOCUMENTATION

Source: Appendix B, Risk Management Guide

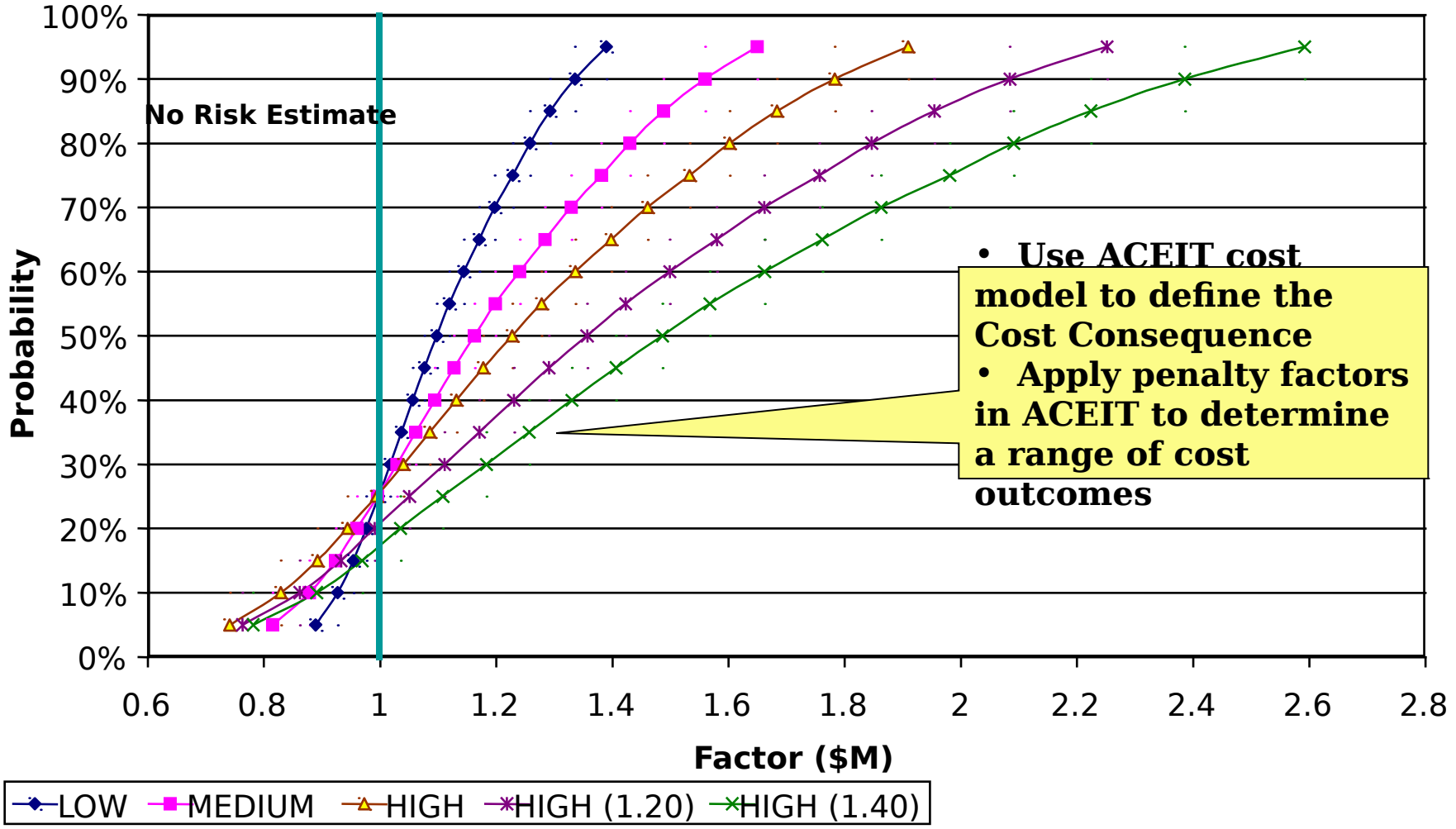
Risk Methodology - Probability

PROBABILITY RISK FACTOR	RISK CATEGORY
	COST
VERY HIGH (81-100%)	Major uncertainties exist related to the scope /definition of the item to be estimated. Highly complex HW and SW. Achievement of cost estimate may be highly dependent on the success of other program, contractor, or government activities. Software application represents new development and no legacy can be applied to SLOC (source lines of code) estimation process.
HIGH (61-80%)	Cost estimate based on uncertainties in scope/definition of the item. Significant increase in complexity, major increase in software modules. Achievement of cost estimate may depend significantly on the success of other program, contractor, or government activities. Software application now represents new development and very little legacy can be applied to SLOC estimation process.
MODERATE (41-60%)	Results from a cost model in which the estimate is feasible and the scope of the system is adequate. Moderate increase in HW and SW complexity and/or performance requirements. Achievement of cost estimates may be dependent on the success of other program, contractor or government activities. SLOC estimates based on very little appropriate legacy and no prototyping activity.
LOW (21-40%)	Item cost estimate based on, or extrapolated from program actuals or supplier information for a very similar item that is already in production. Minor increase in HW and SW complexity or performance requirements. Achievement of cost estimate may be slightly dependent on the success of other program, contractor or government activities, SLOC estimates based on some appropriate legacy and minimal prototyping activity.
VERY LOW (1-20%)	Cost estimate based on vendor quotes for a well defined item, an off the shelf item or a catalog price for an item. No hardware or software change is required. Achieving cost estimates is independent of the success of any other efforts, SLOC estimates are based on significant legacy and prototyping activity.

P(f) based on:

- **Basis of Estimate**
- **Results of Technical Risk Assessment**

Cost Impact of "Penalty Factors"



Risk Methodology - Consequence

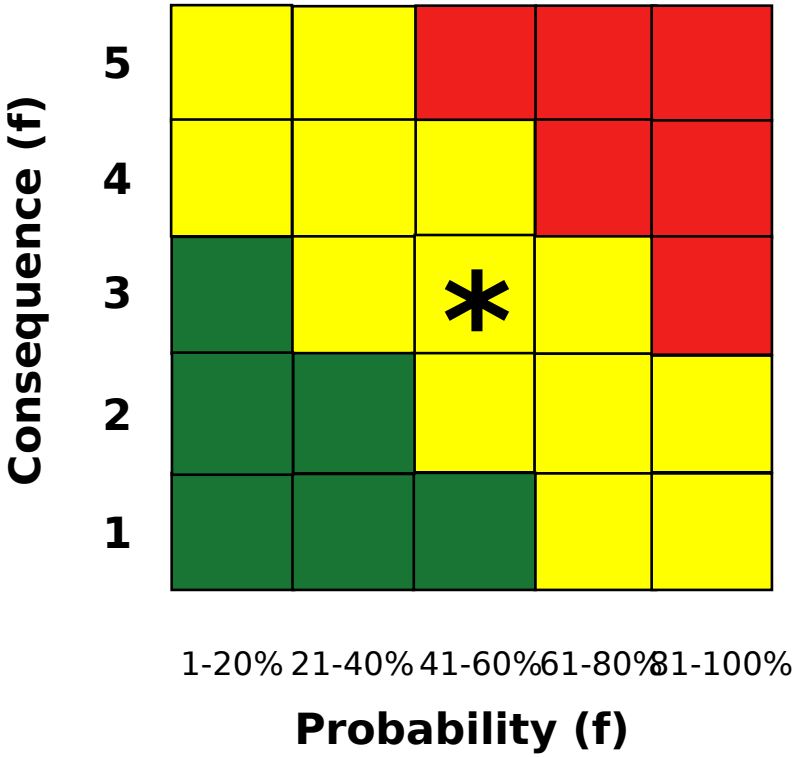
Consequence Rating	Performance Factor Criteria	Schedule Factor Criteria	Cost Factor Criteria
Very high (5)			Issue will result in up to a 50% cost growth over the amount budgeted. Variances over 50% should be addressed in a narrative description.
High (4)			Issue will result in up to a 36% cost growth over the amount budgeted for that WBS.
Moderate (3)			Issue will result in 17-23% cost growth over the amount budgeted for that WBS.
Low (2)			Issue will result in 11-16% cost growth over the amount budgeted for that WBS.
Very Low (1)			Item is expected to stay within budget, with no more than a 10% cost growth to the amount budgeted for that WBS.

NOTE: Tailor Definitions to match the cost model & expected overrun range.

C(f) Unique

- **Defined in terms of the Engineer's Work Breakdown Structure (WBS)**
- **Specific ranges defined in ACEIT (cost estimating model)**
- **Can be tailored for any program**

Defense Acquisition University Risk Matrix



*** Example:**

Issue: Procure new booster

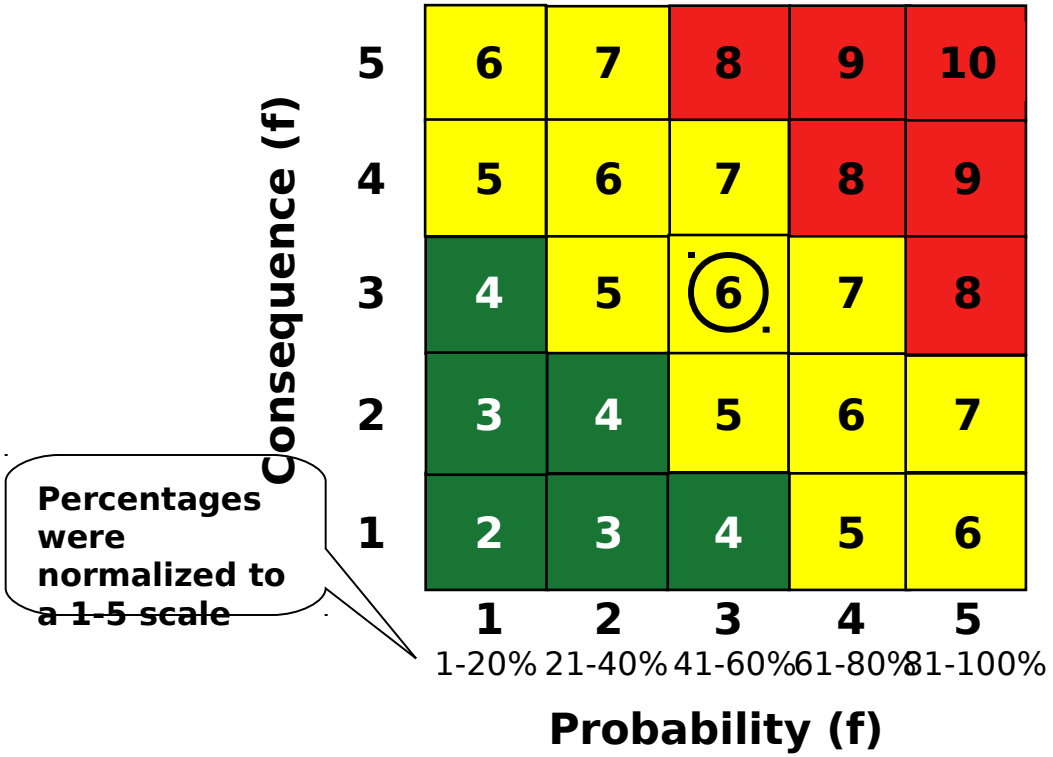
P(f) = 41-60%

C(f) = 3, or expected overrun of 17-23%

Risk =

How Do We Apply this Information within Our Cost Model to Determine Management Reserve for the Expected Overrun ?

Proposed "Risk Exposure" Matrix



Previous Example:

Procuring a new booster

P(f) = 41-60%, or 3

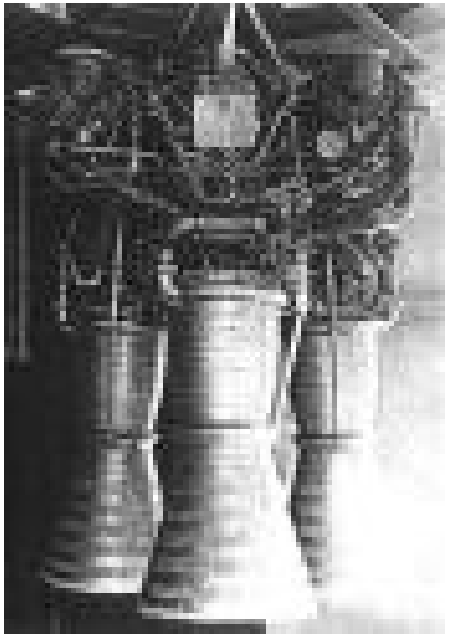
C(f) = 3, then

Risk Exposure =

P(f)3 + C(f) =

Risk Exposure = C(f) + P(f)
Provides Input To Cost Model and Basis for Prioritizing Risk

Boosters – Cost estimating



Low Risk
Risk Exp = 3

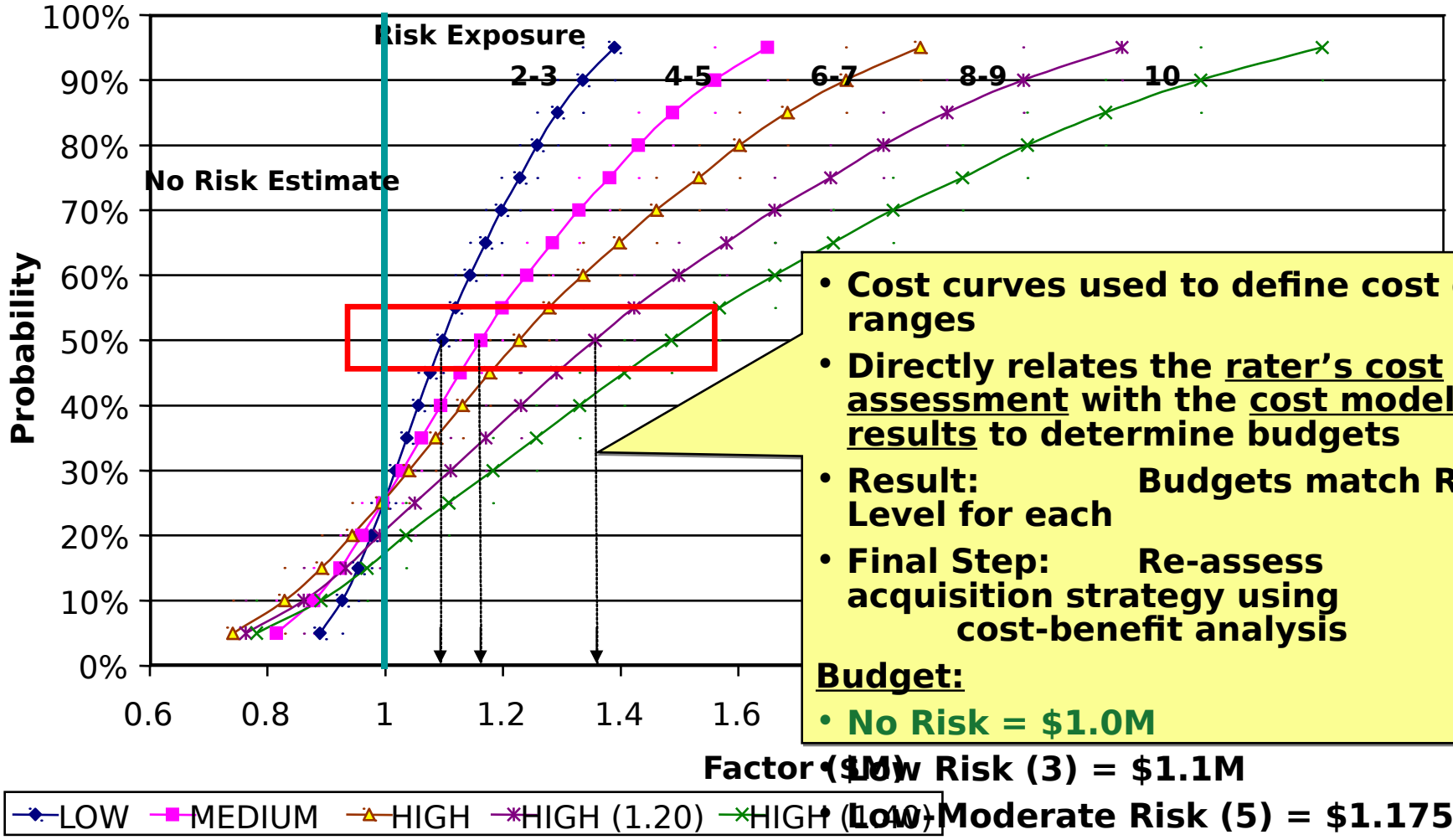
3 Booster Designs With Similar:
- Thrust
- Weight
- Mission

Should we use the same parametric cost estimating relationship (CER) for all

Low-Moderate Risk
Risk Exp = 5

Moderate-High Risk
Risk Exp = 8

Cost Impact of Risk Ratings



- **Cost curves used to define cost c(f) ranges**
- **Directly relates the <u>rater's cost assessment</u> with the <u>cost model results</u> to determine budgets**
- **Result: Budgets match Risk Level for each**
- **Final Step: Re-assess acquisition strategy using cost-benefit analysis**

<u>Budget:</u>

- **No Risk = $1.0M**
- **Low Risk (3) = $1.1M**
- **Low-Moderate Risk (5) = $1.175M**
- **Moderate-High Risk (8) = $1.36M**

Benefits of this Methodology

- Integrates technical and schedule risk assessments with cost estimates
- Helps justify budgets early in the budgeting process
- Accounts for unknown risk factors relating to the specific design
- Improved affordability assessments
- Improved cost-to-benefit analyses between design options

Apply Subjective Risk Assessments in a Logical and Structured Manner

Keys to Success

- **Quality of assessment – Subject Experts and Basis of Assessments**
- **Any risk methodology must be used carefully**
  - Analysis is a must to see if the cost & schedule effects are compounding or mutually exclusive; is there an overlapping effect?
  - Prioritizing risk mitigation resources requires careful consideration
- **Properly define cost consequence to represent cost model results**
- **Identifying areas at the program level, not associated with a WBS**

Apply Subjective Risk Assessments in a Logical and Structured Manner

Summary

- Programs face many challenges fielding new systems
- Proposed approach builds on DoD 5000 & DAU risk methodology; helps PM balance competing requirements
- Risk exposure value is easily understood, allows prioritization of risks, and is a direct input for the cost model
- Determining management reserve will help DoD, services, and programs do more

Integrating Technical, Schedule, & Cost Assessments will Improve the Budgeting Forecasts & Provide a Valuable Decision Making Tool

Questions & Answers

Author Biography

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Defense Acquisition University (DAU)

Education

BS degree, majors in: Math, Business, and Accounting – *B'ham-Southern College*

Master of Arts degree in Financial Accounting - *University of Alabama*

SBLM Program - *Army Management Staff College*

Acquisition Certifications

Certified Public Accountant - *17 years*

Level III in Program Management

Level III in Business, Cost Estimating, & Financial Management

Level III in Systems Planning, Research, Development & Engineering

Level II in Auditing

Work Experience

3 years as Professor of Acquisition Management at DAU

12 years in Program Management for Acquisition Category ID Programs

DoD Risk Management Policy

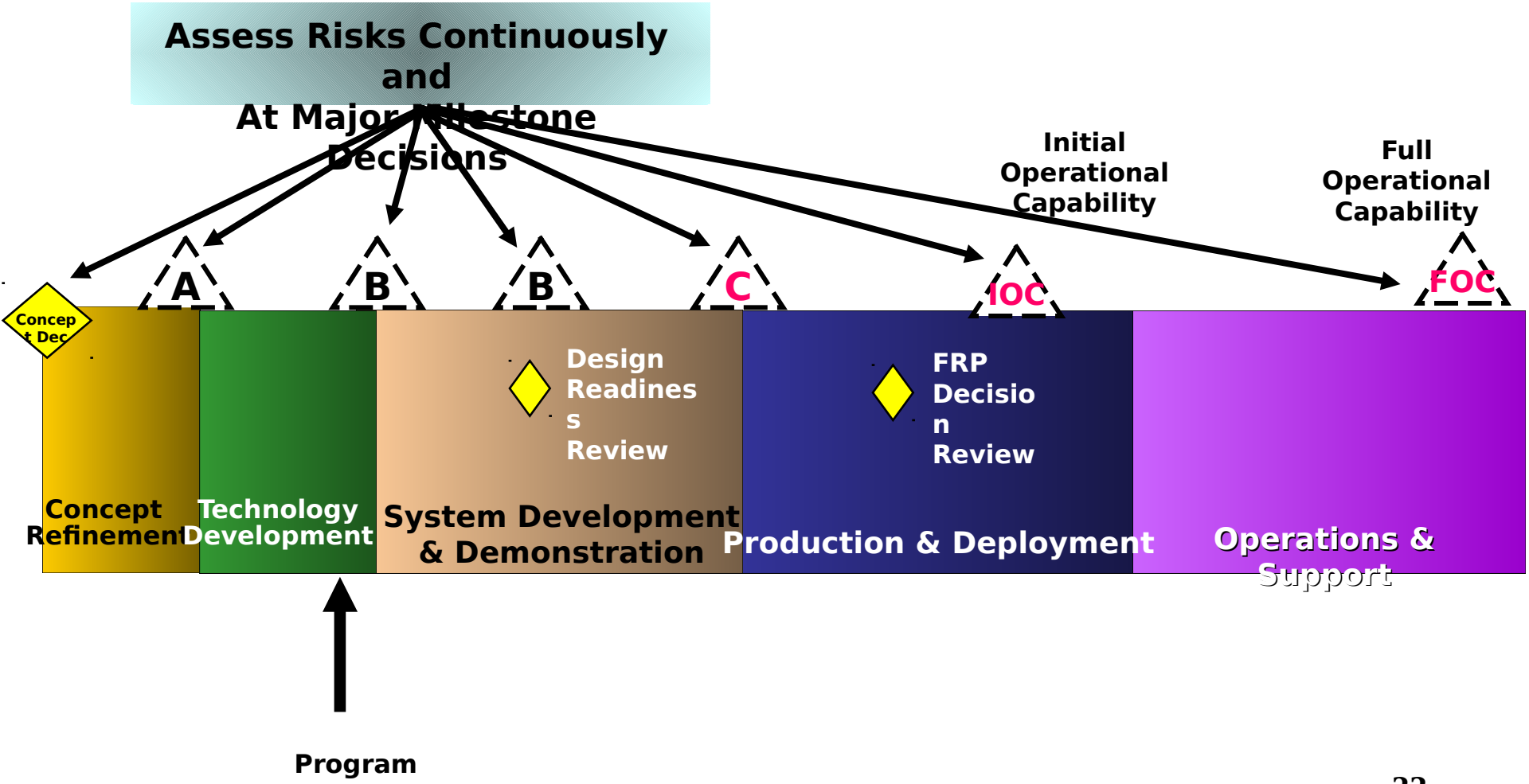
DoD Directive 5000.1, The Defense Acquisition System, 12 May 2003

- Program risks and risk management plans shall be explicitly assessed at each milestone decision point
- Solicitation documents shall require contractors to identify risk and specify plans to assess and eliminate risks or reduce them to acceptable levels
- Program managers provide assessments of program status and risk in all presentations to higher authorities

DoD Directive 5000.2, Operation of the Defense Acquisition System, 12 May 2003

- A risk management program shall be established for each acquisition program to identify and control performance, cost, and schedule risks
- Industry participation in risk management is essential

Defense Acquisition Framework



Industry Applications

Insurance

- **Insurance companies use a similar technique**
- **Life expectancy risk assessments determine premium rates**
- **Life insurance risk factors**
  - Age
  - Drinking / Smoking habits
  - Hobbies (i.e.. Scuba, motorcycles, skydiving)
- **Auto insurance risk factors**
  - Driving record
  - Age & sex
  - Type of vehicle

Department of Defense

- **DoD acquisition programs - harder to assess risk factors**
- **Assessments based on expert opinion**
- **Fewer historical data points**
- **Weapon systems are very complex & historical Cost Estimating Relationships (CERs) do not capture the additional costs of this complexity**
- **Methodology needed to quantify expected cost growth**